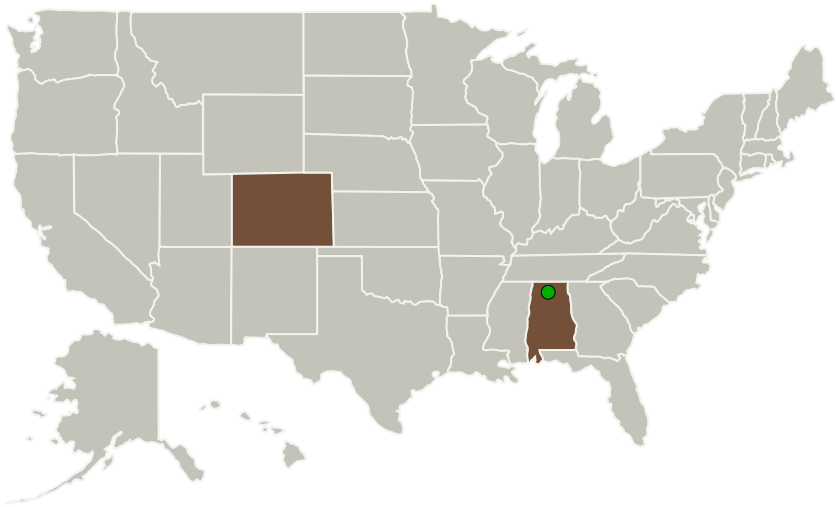
CO2 Removal from Mars EMU, Phase I

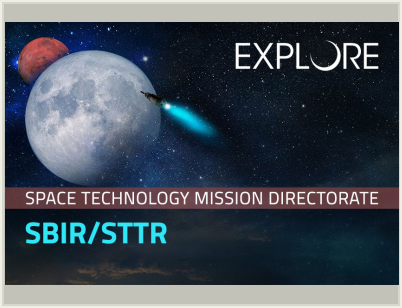
Completed Technology Project (2010 - 2010)

Project Introduction

CO2 control for during ExtraVehicular Activity (EVA) on mars is challenging. Lithium hydroxide (LiOH) canisters have impractical logistics penalties, and regenerable metal oxide canisters weigh too much. Cycling bed systems and permeable membranes that are regenerable in space vacuum cannot vent on Mars due to the high partial pressure of CO2 in the atmosphere. Although sweep gas regeneration is under investigation, the feasibility, logistics penalties, and failure modes associated with this technique have not been fully determined. TDA Research, Inc. proposes to develop a durable, high-capacity regenerable sorbent that can remove CO2 from the breathing loop. The system design allows sorbent regeneration at or above 6 torr, eliminating the potential for Martian atmosphere to leak into the regeneration bed and into the breathing loop. In the proposed work, we will synthesize sorbent formulations to remove CO2 from the breathing loop of the PLSS and evaluate the performance of these sorbents under representative conditions (adsorption and regeneration under sub-atmospheric pressures across the desired temperature differential). We will explore the methods to prepare these sorbents on engineered structures to increase durability and promote better heat transfer during the thermal regeneration process. We will perform a minimum of 1,000 adsorption/regeneration cycles to demonstrate the life of these sorbents. Finally, we will carry out a detailed engineering analysis and design to assess the technical viability of the concept.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
TDA Research, Inc.	Lead Organization	Industry	Wheat Ridge, Colorado
Marshall Space Flight Center(MSFC)	Supporting Organization	NASA Center	Huntsville, Alabama

Primary U.S. Work Locations	
Alabama	Colorado

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140077)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

TDA Research, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

Carlos Torrez

Principal Investigator:

Gokhan Alptekin

Co-Investigator:

Gokhan O Alptekin

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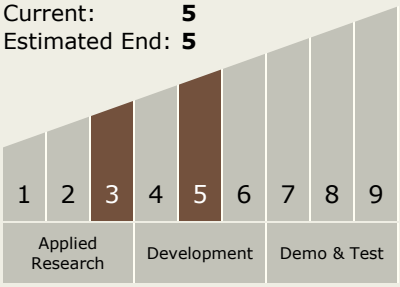
Technology Maturity (TRL)

Start: **3**
Current: **5**
Estimated End: **5**



Technology Areas

Primary:

- TX06 Human Health, Life Support, and Habitation Systems
  - TX06.1 Environmental Control & Life Support Systems (ECLSS) and Habitation Systems
    - TX06.1.1 Atmosphere Revitalization

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System